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CLAIMS

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[Claim(s)]

[Claim 1] The connection arm which connects between the revolving shafts of the planet gear which always gears with sun gear and the above-mentioned sun gear, the above-mentioned planet gear, and the above-mentioned sun gear, At least one stopper member displaced in the condition of canceling with the condition in the above-mentioned connection arm of forbidding rotation of the circumference of the above-mentioned sun gear, The gear coupling device characterized by performing the drive of the driving member which consists of a shape memory alloy with which a different configuration from a steady state is memorized, and which can be displaced, and the above-mentioned stopper member according to the energization condition and the condition of not energizing of the driving member which consists of the above-mentioned shape memory alloy.

[Claim 2] The driving member which consists of the above-mentioned shape memory alloy is a gear coupling device according to claim 1 characterized by having the spring configuration.

[Claim 3] The driving member which consists of the above-mentioned shape memory alloy is a gear coupling device according to claim 1 characterized by having the wire configuration.

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[Translation done.]

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the structure of the gear coupling device for switching and driving a follower gear.

[0002]

[Description of the Prior Art] The gear connection drive for performing a taking-lens attitude drive and a film feed drive in a camera conventionally usually makes a single drive motor a driving source, and the drive which one of two or more of the drive systems-ed which drive each part of the above according to a planet-gear switch device is chosen, and it drives is adopted. As for the above-mentioned planet-gear switch device, the engagement condition is switched by turning on and off of electromagnet equipment.

[0003] What was indicated by JP,8-304894,A has the same drive as the above-mentioned conventional example, makes a single drive motor a driving source, cuts connection of a planet gear with single electromagnet equipment, and replaces.

[0004]

[Problem(s) to be Solved by the Invention] The change-over device of a planet gear in which what was indicated by above-mentioned JP,8-304894,A applied electromagnet equipment also has many components mark, and cost was high, and further, the occupancy tooth space of the above-mentioned electromagnet equipment was large, and it had become trouble at the miniaturization of a camera. Moreover, big power is required for the drive of electromagnet equipment, and there was also a problem [ exhausting / a cell / power ] of being intense.

[0005] This invention is made in order to solve an above-mentioned problem, and it is the gear coupling device structure for driving two or more driven sections of devices, such as a camera, and it is easy to constitute, and the miniaturization of a device is possible for it, and it also aims power consumption at offering few gear coupling devices.

[0006]

[Means for Solving the Problem] The planet gear to which the gear coupling device of this invention according to claim 1 always gears with sun gear and the above-mentioned sun gear, At least one stopper member displaced in the connection arm which connects between the revolving shafts of the above-mentioned planet gear and the above-mentioned sun gear, and the condition of canceling with the condition of forbidding rotation of the circumference of the above-mentioned sun gear in the above-mentioned connection arm, It has the driving member which consists of a shape memory alloy with which a different configuration from a steady state is memorized, and which can be displaced, and the drive of the above-mentioned stopper member is performed according to the energization condition and the condition of not energizing of a driving member which consist of the above-mentioned shape memory alloy.

[0007] The driving member which the gear coupling device of this invention according to claim 2 becomes from the above-mentioned shape memory alloy in a gear coupling device according to claim 1 has the spring configuration.

[0008] The driving member which the gear coupling device of this invention according to claim 3 becomes from the above-mentioned shape memory alloy in a gear coupling device according to claim 1 has the wire configuration.

[0009]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained based on drawing. It is the perspective view showing the zoom drive gear system of a mirror frame and a gear coupling device which is the expansion perspective view showing the configuration and the drive condition of the gear coupling device which

drawing 1 - drawing 4 are the 1 operation gestalten of this invention here, and is built in a zoom camera, and drawing 5 - drawing 8 are the top views showing the operating state of the gear coupling device of a camera, drawing 9 is the perspective view showing the zoom drive gear system of a mirror frame and the above-mentioned gear coupling device in a stowed position, and drawing 10 has in the location which can be photoed. Drawing 11 is an operating state Fig. when driving the 1st stopper with the lever driver built into the above-mentioned gear coupling device, and drawing 11 (A) shows the normal state of not energizing [ of a lever driver ], and shows the condition that drawing 11 (B) carried out the rotation drive of the 1st stopper with the lever driver of an energization condition.

[0010] First, with reference to drawing 1 - drawing 11 , the attitude drive of the lens barrel in the zoom camera having the gear coupling device of the gestalt of this operation, winding up of a film, and the configuration of the above-mentioned gear coupling device which performs a rewinding drive are explained. In addition, in this zoom camera, the component part by the side of the mirror frame shown in drawing 9 and drawing 10 and bodies, such as a zoom drive gear system of a gear coupling device, shall be arranged in the bottom section of the gear coupling device shown in drawing 1 - drawing 4 .

[0011] Single winding up / zoom (W/Z) motor 20 which is the driving source of a gear coupling device are motors which have a pinion gear 21 in the output shaft and in which forward inverse rotation is possible. The above-mentioned pinion gear 21 has geared with the 1st sun gear 30 through a reduction gear train (not shown), and transmits the turning effort of the above-mentioned W/Z motor 20 to the 1st sun gear 30.

[0012] The 1st arm 32 which is a connection arm is arranged in the top face of the 1st sun gear 30 of the above, and it is pivotable on the 1st sun gear 30 and the same axle. Pivot pin 32a is prepared in this 1st arm 32 in the perpendicular condition, and it is fixed to revolve with the condition that the 1st planet gear 31 geared to the 1st sun gear 30 of the above by this pivot pin 32a.

[0013] Predetermined friction is given between the 1st planet gear 31 of the above, and the 1st arm 32 of the above. Therefore, rotation of the 1st sun gear 30 of the above produces the rotation force of the direction which the 1st sun gear 30 rotate on the 1st arm 32 of the above by this friction.

[0014] 32d of protection-from-light sections which shade Heights 32b and 32c and the clutch photo interrupter (clutch PI) 34 mentioned later for stopping rotation of this 1st arm 32 is prepared in the 1st arm 32 of the above.

[0015] On the revolution locus of the 1st planet gear 31 of the above, the 3rd sun gear 60 which are also the gear 36 which is a follower gear fixed to revolve by pivot 36a, and the follower gear fixed to revolve by pivot 60a are arranged. Moreover, the 1st stopper 35 which is a stopper member is supported to revolve with the above-mentioned gear 36 and the same axle by above-mentioned pivot 36a rotatable.

[0016] Stop section 35a stopped and prevented to rotation of the direction of a clockwise rotation (CW) of this 1st arm 32 as are shown in the 1st stopper 35 of the above at drawing 5 (B) and it is indicated in drawing 6 (B) as rotation of the direction of a counterclockwise rotation (CCW) of the 1st arm 32 of the above is prepared. Moreover, the positioning members 33a and 33b are arranged in the surroundings of the 1st arm 32 of the above, and as are respectively shown in drawing 5 (A) and it is indicated in drawing 6 (A) as rotation of the direction of CW of this 1st arm 32, rotation of the direction of CCW is regulated.

[0017] Moreover, the above-mentioned gear 36 geared on the gear 37 fixed to revolve by pivot 37a, and this gear 37 has geared to the 2nd sun gear 38 fixed to revolve by pivot 38a further.

[0018] There is the 2nd arm 45 which is a connection arm in the 2nd sun-gear 38 bottom of the above, and it is rotatable on this 2nd sun gear 38 and same axle. Pivot pin 45a is installed by this 2nd arm 45, and it is fixed to revolve with the condition that the 2nd planet gear 47 geared to this pivot pin 45a at the 2nd sun gear 38 of the above.

[0019] Moreover, predetermined friction is given between the 2nd planet gear 47 of the above, and the 2nd arm 45 of the above. Therefore, rotation of the 2nd sun gear 38 of the above produces the rotation force of the direction which the 2nd sun gear 38 rotate on the 2nd arm 45 of the above by this friction.

[0020] On the revolution locus of the 2nd planet gear 47 of the above, the set gear 48 which is the 1st driving means fixed to revolve by pivot 48a, and the gear 49 fixed to revolve by pivot 49a are arranged.

[0021] The above-mentioned gear 49 transmits the rotation force to the rewind gear 51 as a rewinding drive through the stage gear 50 and 50' which are a reduction gear. If the pawl which engages with the spool shaft in a cartridge and rewinds a film protrudes on this rewind gear 51 (not shown) and this rewind gear 51 rotates in the direction of CW, a film will be rewound in a cartridge.

[0022] The above-mentioned set gear 48 is a possible gear of performing setup actuation in which a mirror frame 83 is

moved from a stowed position (condition of drawing 9 ) to the location (condition of drawing 10 ) which can be photoed, and set down actuation moved from the location which can be photoed to a stowed position. That is, it connects with the set drive-system gear train which uses the set gear for a set drive by the side of a lens barrel as termination, and it is set up so that a mirror frame may carry out by rotation of the direction of CW of this set gear 48 and a mirror frame may carry out set down actuation by setup actuation and rotation of the direction of CCW.

[0023] Moreover, pivot 41a is arranged in the location of the 2nd sun gear 38 of the above, and the bottom in which it does not interfere, and the 2nd stopper 41 is supported to revolve by this pivot 41a rotatable. This 2nd stopper 41 has stop arm 41c which stops and prevents rotation of the direction of CW of the 2nd arm 45 of the above as shown in drawing 5 (A). <BR> [0024] Moreover, the positioning members 43 and 44 are arranged in the surroundings of the 2nd arm 45 of the above, and as are respectively shown in drawing 7 (B) and it is indicated in drawing 5 (B) as rotation of the direction of CW of the 2nd gear arm 45, rotation of the direction of CCW of the 2nd arm 45 is regulated.

[0025] Moreover, protection-from-light section 41b which shades the stopper photo interrupter (stopper PI) 46 mentioned later is prepared in the 2nd stopper 41 of the above.

[0026] The 3rd arm 61 which is a connection arm is arranged in the 3rd sun-gear 60 bottom of the above, and it is supported pivotable on pivot 60a of these sun gear 60, and the same axle. Pivot pin 60b is installed by this 3rd arm 61, and to this pivot pin 60b, the 3rd planet gear 62 and gear 62' which are the stage gear of one gear, and are fixed to revolve at the 3rd sun gear 60 of the above. However, the 3rd planet gear 62 has geared to the 3rd sun gear 60.

[0027] Moreover, predetermined friction is given between the 3rd planet gear 62 of the above and gear 62', and the 3rd arm 61 of the above. Therefore, when the 3rd sun gear 60 of the above rotate, on the 3rd arm 61 of the above, the rotation force of the direction which these 3rd sun gear 60 rotate will arise by this friction.

[0028] On the revolution locus of the 3rd planet gear 62 of the above, the zoom gear 65 which is the 2nd driving means fixed to revolve by pivot 65a, and the wind gear 70 which has in one the spool which winds up a film are arranged. In addition, the zoom gear 65 is arranged in the location in which it does not interfere in these gears 37 and 38 with the above-mentioned gear 37 and 38 down side.

[0029] The mirror frame 83 of this camera is movable in the location (stowed position) Pa contained by the body of a camera of drawing 9 by the gear train which gears with the set gear 48 to it so that built-in maintenance may be carried out and a taking lens may be mentioned later, and the location Pb which it let out from the body of a camera of drawing 10 and which can be photoed.

[0030] And when it is in the above-mentioned location Pb which can be photoed, the focal distance of a taking lens can be switched by making a mirror frame 83 rotate to the circumference of an optical axis O through mirror frame gear 83a prepared in the periphery by the zoom drive gear system 85 which is the zoom driving means mentioned later. The zoom drive gear system 85 of the above-mentioned zoom driving means consists of the gear sections which gear with the zoom gear 65 to it.

[0031] Explanation of the zoom drive gear system 85 which is the above-mentioned zoom driving means arranges the 1st zoom bevel gear gear 80 rotated by one in pivot 65a which supports the zoom gear 65 shown in drawing 1 etc., as shown in the mirror frame of above-mentioned drawing 9 and drawing 10 , and the perspective view of the zoom drive gear system of a gear coupling device. The 2nd zoom bevel gear gear 81 was arranged in the location which gears with this 1st zoom bevel gear gear 80, and this 2nd zoom bevel gear gear 81 has fixed to the driving shaft 82 changed 90 degrees so that it might meet in the direction of optical-axis O of the mirror frame 83 of a camera.

[0032] And zoom long gear 82a as a drive gear of the last stage rotated in one is prepared in the above-mentioned driving shaft 82. This zoom long gear 82a gears with mirror frame gear 83a of a mirror frame 83, when the mirror frame 83 has moved to the location Pb which can be photoed. However, when a mirror frame 83 retreats to a stowed position Pa, mirror frame gear 83a and an engagement condition are canceled.

[0033] Moreover, inclined plane 82b is prepared at the tip of an engagement side of the tooth part of zoom long gear 82a, and inclined plane 83b is prepared also at the tip of an engagement side of the tooth part of mirror frame gear 83a. In addition, both these inclined planes 82b and 83b may be wedge surfaces.

[0034] When performing the drive to the wide location or each zoom location of the mirror frame 83 in the location Pb which can be photoed, rotation of the zoom gear 65 is transmitted to the above-mentioned zoom gear train, and a mirror frame 83 is rotated through zoom long gear 82a. By rotation to the direction of CW (the drawing 10 top the direction of CCW) of drawing 6 (B) of the zoom gear 65, a mirror frame 83 rotates in the zoom down direction. Moreover, if the zoom gear 65 rotates in the direction of CCW (the drawing 10 top the direction of CW) on drawing 6 (A), a mirror

frame 83 will rotate in the zoom-in direction.

[0035] By moreover, the reset photograph reflector (reset PR and ZPR) 84 as a position signal detection means to constitute the non-contact mold zoom encoder mentioned later in a mirror frame 83 Silver seal 83c for wide location detection as 1st location output means and silver seal 83d for tele location detection as 2nd location output means are respectively stuck on the location which detects the wide (wide angle) ready position of the location Pb which can be photoed, and a tele (looking far) location.

[0036] Furthermore, the wind gear 70 and engagement of gear 62' which is a small gear side of the 3rd planet gear 62 which is a stage gear, and the 3rd planet gear 62 which is the chain-sprocket side among gear 62' have become the zoom gear 65 and engagement are possible and possible.

[0037] With the 2nd sun-gear 38 down side of the above, pivot 72a is prepared in these 2nd sun gear 38 and the location in which it does not interfere, it gets down, and the 3rd stopper 72 is supported by this pivot 72a rotatable. As shown in this 3rd stopper 72 at drawing 6 (A), stop arm 72b which stops the rotation to the direction of CCW of the 3rd arm 61 of the above is arranged.

[0038] Moreover, the positioning members 63 and 64 are arranged in the surroundings of the 3rd arm 61 of the above, and as are shown in drawing 6 (B) and it is indicated in drawing 7 (A) as the rotation to the direction of CW of the 3rd arm 61, the rotation to the direction of CCW of the 3rd arm 61 is regulated.

[0039] The 1st stopper 35 of the above is rotatable focusing on the above-mentioned pivot 36a, and projection 35b to which the suspension of the lever driver 40 which is \*\*\*\*\* mentioned later is carried out is installed.

[0040] The above-mentioned lever driver 40 fabricates shape memory alloy wire production material in the shape of a coil spring. In addition, although the above-mentioned lever driver 40 has the coil-spring configuration, it may apply the thing of for example, not only this but a torsion spring configuration, a linear wire configuration, or a U character configuration.

[0041] The above-mentioned shape memory alloy is an ingredient which will be recovered in the configuration before deformation if it heats beyond proper temperature even if it deforms into the configuration of arbitration, and the thing made from a NiTi alloy is excellent in property. And usage as a torsion spring of a flat spring can be done in a plate or a wire rod form like general spring material. Moreover, in order to heat a shape memory alloy, the energization method of a reaction is the quickest. However, since the edge of a shape memory alloy is difficult to solder, approaches, such as wirebonding, a pressure welding of a contact piece, and a pressure welding of a flexible substrate, are used.

[0042] Although adjustment is possible with the class of alloy, when using it for the drive of a camera, about 70 degrees C which is the temperature beyond anticipated-use environmental temperature are suitable for the proper temperature of the above-mentioned shape memory alloy.

[0043] To carry out and heat backlash by the energization method, it is necessary to set up a current value in consideration of the internal resistance by the configuration, the property of an alloy, etc. Moreover, the drive circuit is good in a simple switching circuit.

[0044] The suspension of the lever driver 40 which consists of the above-mentioned shape memory alloy is carried out to projection 35b which has the end of the spring hook section on the 1st stopper 35, the suspension of the other end is carried out to the body side support pin 39 of a camera, and it is supported. Driver voltage can be impressed to the above-mentioned lever driver 40 through above-mentioned projection 35b and the support pin 39.

[0045] in the usual condition that driver voltage is not impressed to the above-mentioned lever driver 40, the lever driver 40 is shown in drawing 11 (A) -- as -- an overall length -- L1 The 1st configuration SH1 in the condition of having extended it holds -- having -- the 1st stopper 35 -- a pivot 36a core -- the Da direction (the direction of CW) -- 1st location LP 1 up to -- a rotation drive is carried out. Rotation actuation of the 1st arm 32 is regulated in the condition.

[0046] moreover -- if driver voltage is impressed to the above-mentioned lever driver 40 and it energizes -- the lever driver 40 -- temperature -- going up -- the left -- contracting -- an overall length -- L2 The 2nd configuration SH2 which it becomes and is shown in drawing 11 (B) becoming -- the 1st stopper 35 -- a pivot 36a core -- the Db direction (the direction of CCW) -- 2nd location LP 2 up to -- a rotation drive is carried out. In the condition, the 1st arm 32 is released from a rotation regulation condition.

[0047] When it energizes to the lever driver 40 made from the above-mentioned shape memory alloy, as mentioned above, it is the 2nd configuration SH2. It contracts, and through projection 35b, the 1st stopper 35 rotates in the direction of CCW, as shown in drawing 5 (B). And when the energization to the lever driver 40 is intercepted, for the

1st stopper 35, the lever driver 40 is the 1st configuration SH1. Since it returns, the 1st arm 32 is rotated in the direction of CW, as shown in drawing 5 (A).

[0048] Stop section 35a is prepared in an end at the 1st stopper 35 of the above, and arm 35c is prepared in the opposite end. In addition, this arm 35c is arranged in the above-mentioned gear 37 bottom, and interference with a gear 37 is avoided.

[0049] The 2nd stopper 41 of the above has become rotatable focusing on the above-mentioned pivot 41a, 41f of gear sections is prepared, arm 41e is prepared in the right end section, and 41d of heights is further prepared at the tip of stop arm 41c.

[0050] Moreover, near the 2nd stopper 41 of the above, pin 42a is installed from the body (not shown), and the torsion spring 42 is inserted in this pin 42a. The end of this torsion spring 42 is hung on the above-mentioned positioning member 43, and the other end is hung on the end of the 2nd stopper 41 of the above, and is energizing this stopper 41 in the direction of CCW. In addition, the 2nd stopper 41 is arranged in the above-mentioned gear 37 and 38 bottom, and interference with each gears 37 and 38 is avoided.

[0051] The 3rd stopper 72 of the above has become rotatable focusing on the above-mentioned pivot 72a, and gear section 72c is prepared in a central part, and stop arm 72b is arranged in the right end section, and 72d of arms is further arranged in the left end section.

[0052] Near the 3rd stopper 72 of the upper part, the gage pin 73 is installed from the body (not shown), and rotation of the direction of CW of this 3rd stopper 72 has regulated. Moreover, the 3rd stopper 72 is arranged in the above-mentioned gear 37 and 38 bottom, and interference with each gears 37 and 38 is avoided.

[0053] If it has geared mutually and this 2nd stopper 41 rotates in the direction of CW, the 3rd stopper 72 will rotate 41f of gear sections of the 2nd stopper 41 of the above, and gear section 72c of the 3rd stopper 72 in the direction of CCW. Although this 2nd stopper 41 is energized in the direction of CCW with the above-mentioned torsion spring 42, since the 3rd stopper 72 of the above is guessed and attached to the above-mentioned gage pin 73, it is held in the location shown in drawing 5 (A).

[0054] Moreover, arm 41e of the 2nd stopper 41 of the above and arm 35c of the 1st stopper 35 of the above have a clearance between some in the rotation direction, and the height direction is arranged in homotopic.

[0055] If it energizes to the above-mentioned lever driver 40, the lever driver 40 will serve as the 2nd configuration SH2, will be displaced leftward, and will rotate the 1st stopper 35 of the above in the direction of CCW. Stop section 35a of this 1st stopper 35 rotates to the outside of the rotation locus of the 1st arm 32 of the above, i.e., the location where heights 32b does not contact even if the 1st arm 32 rotates, in that case.

[0056] Moreover, since arm 35c of this 1st stopper 35 rotates resisting the energization force of the above-mentioned torsion spring 42, and pressing arm 41e of the 2nd stopper 41 of the above in case the 1st stopper 35 rotates in the direction of CCW, this 2nd stopper 41 rotates in the direction of CW, and, thereby, rotates the 3rd stopper 72 of the above in the direction of CCW.

[0057] At this time, stop arm 41c of the 2nd stopper 41 rotates to the location which does not contact even if the location besides the rotation locus of heights 45b which stops rotation of the 2nd arm 45 of the above, i.e., heights 45b of the 2nd arm 45, rotates. Moreover, stop arm 72b of the 3rd stopper 72 rotates out of the rotation locus of heights 61b for stopping rotation of the 3rd arm 61 of the above (refer to drawing 8 (A)).

[0058] Moreover, when the energization to the above-mentioned level driver 40 is intercepted, the level driver 40 is the 1st configuration SH1. Return and the 1st stopper 35 are rotated in the direction of CW.

[0059] With rotation actuation of the 1st stopper 35 of the above, the 2nd stopper 41 of the above and the 3rd stopper 72 rotate until 72d of arms of this 3rd stopper 72 is respectively guessed and attached to a gage pin 73 in the direction of CCW, and the direction of CW according to the energization force of a torsion spring 42 (refer to drawing 5 (A)). In addition, stop arm 72b of the 3rd stopper 72 is above arm 41e of the 2nd stopper 41, and has the clearance between some in the thrust direction.

[0060] In this gear coupling device, when the rewind gear 51 rotates in the direction of CW, actuation which rewinds a film in a cartridge is performed. Moreover, if the wind gear 70 rotates in the direction of CW, winding up of a film will be performed. Moreover, when the set gear 48 rotates in the direction of CW, setup actuation which lets out a mirror frame 83 to the location Pb of drawing 10 which can be photoed from the stowed position Pa of drawing 9 is performed. Mirror frame gear 83a of a mirror frame 83 and zoom long gear 82a will be in an engagement condition then.

[0061] When the set gear 48 rotates in the direction of CCW, set down actuation which rounds a mirror frame 83 to the stowed position Pa of drawing 9 is performed. In this condition, engagement with mirror frame gear 83a of a mirror frame 83 and zoom long gear 82a is canceled.

[0062] If the zoom gear 65 rotates in the direction of CW (on drawing 6 (B)) in the condition which is shown in drawing 10 and which can be photoed as mentioned above, zoom down actuation of a mirror frame 83 will be performed. On the other hand, if the zoom gear 65 rotates in the direction of CCW (on drawing 6 (A)), zoom-in actuation of a mirror frame 83 will be performed.

[0063] It moves to the location Pb which is shown in drawing 10 from the stowed position Pa which a mirror frame 83 shows to drawing 9 when setup actuation is performed and which can be photoed, and if it moves and setup actuation completes also in the location of silver seal 83c for wide location detection stuck on the mirror frame 83, it is located just under reset (ZPR) PR 84 in the silver seal 83c for wide location detection, and the output signal of reset PR 84 will change from OFF to ON.

[0064] Moreover, if set down actuation is performed, from the location Pb which a mirror frame 83 shows to drawing 10 and which can be photoed, it moves to the stowed position Pa shown in drawing 9, and engagement with mirror frame gear 83a of a mirror frame 83 and zoom long gear 82a will separate, silver seal 83c for wide location detection will also move, and the output signal of reset PR 84 will change from ON to OFF.

[0065] As mentioned above, setup actuation or set down actuation is performed by transmitting the driving force by the gear drive system of the gear 36 which constitutes the 1st driving means, a gear 37, the 2nd sun gear 38, the 2nd planet gear 47, the 2nd arm 45, and the set gear 48.

[0066] Moreover, zoom down actuation or zoom-in actuation is performed by transmitting the driving force by the gear drive system of the 3rd sun gear 60 which constitute the 2nd means of operation, the 3rd planet gear 62, the 3rd arm 61, and the zoom gear 65.

[0067] Next, the block diagram of drawing 12 explains the configuration of the control device of the zoom camera having the gear coupling device of 1 operation gestalt mentioned above. Actuation of this whole zoom camera is controlled by CPU101 which is a microcomputer. That is, CPU101 manages sequence control, an automatic focus / auto exposure (it abbreviates to AF/AE hereafter) operation, A/D conversion, LCD, LED control, and switch control of the above-mentioned zoom camera.

[0068] As each control member of the above-mentioned zoom camera, the LCD panel 102 is a liquid crystal display panel which displays the result of the number of pieces of a film, the mode of a camera, time amount, and a dc-battery check etc., respectively.

[0069] 1st step switch 1R which is the release switch which the switch control unit 103 operates when half-push [ release \*\* ], and locks AF and AE, 2nd step switch 2R which operates when all push [ release \*\* ] and which is a release switch for shutter release, The zoom switch which consists of a zoom-in switch (ZUPSW) for zoom-in, and a zoom down switch (ZDNSW) for a zoom down, The flash plate switch (flash plate SW) for changing the luminescence condition of the stroboscope of a camera, The self switch (self SW) which enables it to use remote control and self-timer ability, The set switch (set SW) for making the mode switch (mode SW) for switching the display of a date, and time amount correction of a date, It consists of a power switch (power SW) which switches ON/OFF of the power source of a camera, a compulsive rewind switch (RWSW) for compulsive rewinding which performs rewinding under photography, and a flesh-side lid-open close switch (BKSW) which winds having shut the back lid rapidly by detecting.

[0070] AF-IC104 is IC for AF ranging, the distance to a photographic subject is found based on the control signal from the above CPU 101, and the ranging data is transmitted to CPU101 through a serial data bus.

[0071] EEPROM105 is eliminable ROM electrically and has memorized various adjustment values, such as the number of pieces of a film, the location pulse when carrying out zoom PR change, charge electrical-potential-difference information on a stroboscope, positional information of the 1st, 2, and 3 arm, positional information of a zoom, zoom positional information, and dc-battery check information.

[0072] The stroboscope unit 106 will start charge, if a charge signal is given from the above CPU 101, a charge electrical potential difference is serially sent to this CPU101, after A/D change is carried out, it is compared with the charge electrical-potential-difference information memorized by EEPROM105, and it is confirmed whether to be the completion of charge.

[0073] The LED display 107 is a display which tells a photography person about stroboscope luminescence warning,



AF lock, etc.

[0074] IF-IC109 is IC for an interface, and is constituted by the LED drive circuit, the circuit which measures the strength of the light by the photometry component SPD 108, the motor drive circuit, the reference voltage circuit, etc.

[0075] IC110 for motorised is IC which drives actuators other than various drive motors, such as plunger equipment and a lever driver, and once the motorised signal sent out from the above CPU 101 is decoded within above-mentioned IF-IC109, it is supplied to this IC110 grade for motorised. And by the signal of CPU101, in order to choose the shutter plunger equipment 112 grade which makes winding up / zoom motor (W/Z motor) 20, and the 111 sector motor for a lens drive (LD motor) open and close through IC110 for motorised, to drive and to cancel the ban on rotation of the above-mentioned sun gear further, energization processing for deforming by heating the lever driver 40 made from a shape memory alloy is chosen and performed.

[0076] Near the above-mentioned LD motor 111, LDPI114 which is the photo interrupter which is interlocked with rotation of this motor 111 and generates an output signal is formed, and the output signal is inputted into the above CPU 101 through above-mentioned IF-IC109, and controls this motor 111 based on the input signal.

[0077] The photo interrupter (AEPI) 115 for shutters outputs the signal which synchronized with sector closing motion by energization to shutter plunger equipment 112.

[0078] A clutch PI 34 will be in a light transmission condition, when the 1st above-mentioned arm 32 is in the location in which a setup / down, or film rewinding is possible, it outputs the signal of ON, when it is in the location in which zoom-in / down, or film winding up is possible, it is shaded, and it outputs an off signal.

[0079] It will be shaded if the driving force of the motor mentioned above will be in a light transmission condition, and outputs ON, when all the stoppers of the 1-3rd stoppers have fallen, and which stopper of the 1-3rd stoppers is going up, and a stopper PI 46 outputs OFF.

[0080] When the driving force of the above-mentioned W/Z motor 20 is transmitted to the feed side, the W/Z motor 31 is controlled by the photograph reflector 116 for film movement magnitude detection (the following, WPR, and publication) which outputs a signal according to the clutch PI 34 of a photo interrupter and the movement magnitude of a film which were mentioned above. The W/Z motor 20 will perform zoom-in actuation, if it is made to rotate in the normal rotation direction, and if it is made to rotate in the inversion direction, it will perform zoom down actuation.

[0081] When the driving force of the above-mentioned W/Z motor 20 is transmitted to the zoom side, as mentioned above, based on a clutch PI 34 and the output signal of reset PR 84, it is controlled by CPU101.

[0082] The DX code 120 of a film is directly read into CPU101, and is used as an operation value for deciding exposure value.

[0083] Drawing 13 shows the flow chart of a photography sequence including drive control of connection gear equipment after turning on the power source of the above-mentioned zoom camera. The control by this photography sequence is processed as that by which it is already loaded with the film into the camera.

[0084] In addition, first, if each function of each output gear of a gear coupling device is explained, if the rewind gear 51 of drawing 5 (A) rotates in the direction of CW, a film will be rewound in a cartridge.

[0085] Moreover, if the set gear 48 rotates in the direction of CW, the lens mirror frame 83 will carry out setup actuation, and on the other hand, if it rotates in the direction of CCW, set down actuation of the lens mirror frame 83 will be performed.

[0086] And if the zoom gear 65 rotates in the direction of CCW, the lens mirror frame 83 will carry out zoom down actuation, and if it rotates in the direction of CW, zoom down actuation of the lens mirror frame 83 will be performed.

[0087] Furthermore, if the wind gear 70 rotates in the direction of CCW, winding-up actuation of a film will be performed.

[0088] As a gear train of the driving gear of the camera in the power-off condition of a camera The 1st arm 32 is in a set/rewinding side, i.e., the location where the planet gear 31 has geared with the gear 36. The 2nd arm 45 It is in the location where the set gear 48 gears with a planet gear 47, and it is in the location where the zoom gear 65 gears with a planet gear 62, and the 3rd arm 61 is in the condition (refer to drawing 12) of being contained in the camera, and has collapsed the lens mirror frame 83 containing the taking lens of a camera.

[0089] Such information shall be kept as arm positional information and zoom positional information in EEPROM105.

[0090] Hereafter, drive control of a camera is explained according to a flow chart. ON of the power switch (electric power switch) of a camera performs initial setting, such as initialization of CPU101 which is a control means, a check of supply voltage, and a call of EEPROM data, (step S99).



[0091] And in order to move the lens mirror frame 83 to a camera station from a collapsing position, it switches to the engagement condition that the set gear 48 can be driven (step S100). (refer to drawing 5 (A)) However, since the planet gear 47 has geared with the set gear 48, actuation is not already performed anew.

[0092] Then, setup actuation which makes the lens mirror frame 83 of a camera drive to the location (to refer to drawing 10) which can be photoed from a stowed position (refer to drawing 9) is performed (step S101).

[0093] The lens mirror frame 83 is made to let out, and it is made to consider as the condition of having chosen Motor PI and reset PR 84, to drive a motor 20 in the direction of CW, and to drive in this processing, until it checks that the signal of reset PR 84 has changed from OFF to ON and the output of Motor PI stops.

[0094] If this setup processing is performed, from a collapsed state, the zoom positional information of EEPROM105 will write to the completion condition of a setup (condition which can be photoed), and will be changed, and drive information will be written in if it is in zoom-in actuation.

[0095] After setup control is completed, zoom gear switch processing for switching to the condition that a gear drive system can be geared and driven on the zoom gear 65 for performing zoom-in/down is performed (step S102). This processing is processing which switches the 1st arm 32 to zoom/winding-up side from a set/rewinding side (refer to drawing 6 (A)).

[0096] And the lens mirror frame 83 is made to drive to a wide location, and it changes into the condition which can be photoed (step 103).

[0097] Then, although various kinds of processings are made according to the switch input of a camera, when it judges whether the release switch was pushed first and the ON signal was detected (step S104) and the ON signal of a release switch is detected, in step S105-108 continuing, processing of photography and one-piece winding up is performed.

[0098] That is, when ON of a release switch is detected, the distance to a photographic subject is measured (step S105), it lets out an auto-focus lens (focal lens) based on this ranged data, shutter actuation is performed, and a film is made to expose (step S106).

[0099] After exposure is completed, in order to wind up a film, it switches to the condition of gearing on the wind gear 70 for film winding up, from the condition of having geared on the zoom gear 65 for performing zoom-in/down (step S107). This processing is processing which switches the 3rd arm 61 to a winding-up side from a zoom side (refer to drawing 7 (A)).

[0100] Using the photograph reflector WPR116 for film movement magnitude detection, and detecting film movement magnitude after a switch, a motor 20 is driven in the direction of CCW, and a film is wound up by one piece (step S108).

[0101] Moreover, when actuation of a release switch is not detected in the above-mentioned step S104, it judges whether zoom-in/down switch (zoom switch) was operated (step S109).

[0102] When the above-mentioned zoom switch is operated, it progresses to processing of steps S110 and S111. That is, at this time, although the gear drive system of the driving gear of a camera is in the engagement condition that the wind gear 70 can be driven (refer to drawing 7 (A)), if a zoom switch is operated, a gear drive system will be switched to the engagement condition that the zoom gear 65 can be driven from an engagement condition with the wind gear 70 (step S110). In this case, the 3rd arm 61 is switched so that the zoom side 62, i.e., a planet gear, may gear with the zoom gear 65 from a winding-up side (refer to drawing 6 (B)).

[0103] And when the zoom-in switch of the zoom switches is pushed, a motor 20 is driven in the direction of CCW, zoom-in actuation is performed, and on the other hand, the drive of the above-mentioned motor 20 is continued until drive a motor 20 in the direction of CW, it performs a zoom down, and a zoom switch is turned off or it reaches to a call / wide location, when a zoom down switch is pushed (step S111).

[0104] It judges [ whether it is completed any of the above-mentioned steps S108 and S111 they are, and ] whether in step S109, when a zoom switch was off, it was performed any of detection of off detection of a power switch and a film end or ON detection of a compulsive rewind switch they are (step S112), or when not detected, it returns to the above-mentioned step S104, and above-mentioned processing is repeated.

[0105] When it is performed any of off detection of a power switch, detection of a film end, or ON detection of a compulsive rewind switch they are, in order to, perform processing made to collapse the lens mirror frame 83 on the other hand, it progresses to step S113-116 continuing.

[0106] First, the gear drive system of the driving gear of a camera is switched to the condition of having geared on the zoom gear 65 in which zoom-in/down is possible (step S113). According to the condition of the gear in the time of

decision of said step S104, especially when the zoom gear 65 is already in the engagement condition, it is not operated.

[0107] Then, a motor 20 is driven in the direction of CW to the location (refer to drawing 13 ) where collapsing of the lens mirror frame 83 is attained, and a zoom down is carried out until the output of Motor PI is lost (step S114).

[0108] After processing of this zoom down is completed, in order to make the lens mirror frame 83 collapse, a gear drive system is switched to the condition of having geared on the set gear 48, from the condition which geared on the zoom gear 65 (step S115). In this case, in the 1st arm 32, from wind/zoom side, as set/rewind side 31, i.e., a planet gear, gears with a gear 36, it is switched (condition of drawing 5 (A)).

[0109] When it will be in this switch condition, a motor 20 is driven in the direction of CW, and the lens mirror frame 83 is made to collapse (step S116).

[0110] Then, by having wound up the film, having detected the film end to inside or having pushed the compulsive rewind switch on it, when it judges whether the rewinding demand occurred (step S117) and there is no rewinding demand, processing by this flow chart is ended as it is.

[0111] On the other hand, when a rewinding demand occurs, in order to rewind a film, it switches to the condition that the rewind gear 51 can be driven, from the condition of having geared the gear drive system on the set gear 48 (step S118). This processing actuation is switch actuation which the 2nd arm 45 is rotated [ actuation ] and meshes a planet gear 47 on the gear 49 of a rewinding system from the set gear 48 ( drawing 7 (B)).

[0112] Detecting said output of WPR116, if it detects that the planet gear 47 geared on the gear 49 of a rewinding system, a motor 20 will be made to drive in the direction of CW, and a film will be rewound until this output of WPR is lost (step S119).

[0113] Termination of rewinding [ of a film ] switches the 2nd arm 45 so that a planet gear 47 may separate from the gear 49 of a rewinding gear system and may gear on the set gear 48, so that it may be in the condition that a gear drive system gears on the set gear 48 (step S120). (refer to drawing 5 (A))

[0114] After performing rewinding, it judges whether the user took out the film and loaded with a new film into the camera (step S121), and when re-loading of a film is not made, processing by this flow chart is ended as it is.

[0115] On the other hand, when re-loaded with the film, in order to perform reserve winding up, processing of continuing step S122-124 is performed.

[0116] That is, if it detects having been re-loaded with the film into the camera, in order to wind up a film, first, the 1st arm 32 is switched to zoom/winding-up side from a set/rewinding side, next the 3rd arm 61 is switched to a winding-up side from a zoom side so that it may be in the condition that a gear drive system gears on the wind gear 70 (step S122).

[0117] After switching, reserve winding up which winds up a film by the number of predetermined pieces is performed by driving a motor 20 in the direction of CCW, referring to the output of the above WPR116 (step S123).

[0118] After this reserve winding up is completed and switching the 3rd arm 61 to a zoom side from a winding-up side so that it may be in the condition that a gear drive system gears on the set gear 48, the 1st arm 32 is switched to a set/rewinding side from zoom/winding-up side (step S124), and this routine is terminated.

[0119] Next, detailed control of each above-mentioned switch processing called by the photography sequence including drive control of above-mentioned drawing 13 is explained. Drawing 14 is a flow chart which shows the flow of the above-mentioned gear switch processing.

[0120] As explained in above-mentioned drawing 13 , when the directions switched to the condition that each output gear, such as a set gear switch, a rewind gear switch, a zoom gear switch, and a wind gear switch, can be driven are made by the present condition and present switch input of a camera, the routine shown in above-mentioned drawing 14 is called.

[0121] And the drive target position of the 1st, 2nd, and 3rd arm 32, 45, and 61 is set up, respectively (step S127).

[0122] That is, it sets the location rotated in the condition of gearing to the set/rewinding side 36, i.e., a gear, to the 1st arm 32 as a target position to switch first the target position of these 1st, 2nd, and 3rd arms 32, 45, and 61 to the engagement condition that the set gear 48 can be driven. Furthermore, the location which rotated the location rotated in the condition of gearing on the set gear 48 to the 2nd arm 45 in the condition of gearing on the zoom gear 65 to the 3rd arm 61 is set as a target position, respectively.

[0123] Next, to switch to the condition that the rewind gear 51 can be driven First, the location rotated in the condition of gearing to the set/rewinding side 36, i.e., a gear, to the 1st arm 32 Furthermore, the condition of having rotated the location rotated in the condition of gearing on the gear 49 of a rewinding system to the 2nd arm 45 in the condition of gearing on the zoom gear 65 to the 3rd arm 61 is set as each target position.

[0124] Furthermore, the location which rotated the location which rotated the location rotated to the condition gear to the 1st arm 32 to zoom/winding-up side 60, i.e., the 3rd sun gear, to the condition gear on the set gear 48 to the 2nd arm 45 to the condition gear on the zoom gear 65 to the 3rd arm 61 sets as each target position to switch to the engagement condition that a zoom gear 65 can drive.

[0125] And to switch to the engagement condition that the wind gear 70 can be driven The location rotated to the condition of gearing to the 1st arm 32 to zoom/winding-up side 60, i.e., the 3rd sun gear Furthermore, the location which rotated the location rotated to the condition of gearing on the set gear 48 to the 2nd arm 45 to the condition of gearing on the wind gear 70 to the 3rd arm 61 is set as a target position, respectively.

[0126] However, when the gear train has geared with current on the wind gear 70 to switch the set gear 48 to an engagement condition, it switches so that the zoom gear 65 may be in an engagement condition at the beginning (step S125,126).

[0127] Next, after processing a target setup in the above-mentioned step S127, it compares whether the current arm location memorized by EEPROM105 and an actual location detectable [ with two location detection means, a stopper PI 46 and a clutch PI 34, ] are equal (step S128).

[0128] That is, in the switch to said set gear 48 side of the condition of having stored in present EEPROM data, the condition of ON and a stopper PI 46 must be turned on by the condition of a clutch PI 34. In the switch to the rewind gear 51 side, the condition of ON and a stopper PI 46 must be turned off by the condition of a clutch PI 34. In the switch to the zoom gear 65 side, the condition of OFF and a stopper PI 46 must be turned on by the condition of a clutch PI 34. In the switch to the wind gear 70 side, the condition of OFF and a stopper PI 46 must be turned on by the condition of a clutch PI 34.

[0129] When correspondence with the above arm positional information memorized and the condition of each PI 34 and 46 is not right, a gear engagement condition is initialized, and the set gear 48 is made into an engagement condition, and the lens mirror frame 83 is made to collapse (step S129).

[0130] Then, when the lens mirror frame 83 suits the condition which can be photoed before judging whether the lens mirror frame 83 was under collapsing (step S130) and performing gear initialization mentioned later, the lens mirror frame 83 is made to drive to a wide location (step S131).

[0131] When the lens mirror frame 83 is under collapsing in the above-mentioned step S130 when this step S131 is completed or, initial setting which sets up initialization, interruption, etc. of use RAM data required for control is processed (step S132).

[0132] Then, control which switches the 1st arm 32 to the engagement condition by the side of [ a zoom side/winding-up side to ] a set/rewinding to switch a gear drive system to the set gear 48 or rewind gear 51 side is performed, and on the other hand, control which switches the 1st arm 32 to the engagement location condition by the side of [ a set side/rewinding side to ] a zoom/winding up performs to switch a gear drive system to the zoom gear 65 or wind gear 70 side (step S133).

[0133] After switch termination of this 1st arm 32 carries out rotation control of the 2nd arm 45 or the 3rd arm 61 in the location which gears with each target gear.

[0134] Then, it judges whether the 1st arm 32 was switched to which [ by the side of a set/rewinding, and a zoom/winding up ] side (step 134).

[0135] When the target position of the 1st arm 32 is a switch location ( drawing 14 indicates a S/R side) by the side of a set/rewinding, it judges whether he wants to switch to the wanting-to switch to set gear 48 side, or rewind gear 51 side (step S135).

[0136] When controlling to rotate the 2nd arm 45 to the location which gears on the set gear 48 when switching to the set gear 48 side (step S136) and switching to the rewind gear 51 side, it controls to rotate the 2nd arm 45 to the location which gears on a gear 49 (step S137).

[0137] On the other hand, when the target position of the 1st arm 32 is a switch location by the side of a zoom/winding up, it controls to rotate the 3rd arm 61 according to the target-position information to the location which gears on the zoom gear 65 or the wind gear 70 (step S 138-140).

[0138] Gear switch processing is completed by processing to \*\*\*\*.

[0139] Since it becomes the cause of malfunction after a gear switch when the 1st arm 32 has moved with the impact to a camera during switch control of the 2nd arm 45 or the 3rd arm 61, the condition of a clutch PI 34 is detected and the positional information of the 1st rewritten arm 32 confirms whether it is equal to the condition of having been detected

by the clutch PI 34 (step S141,142).

[0140] When the positional information of the condition of having been detected by the clutch PI 34, and the 1st arm 32 differs, it jumps on a damage as error processing.

[0141] On the other hand, when information is in agreement in the above-mentioned step S142, a dc-battery check is performed (step S143), the condition of the gear train switched at the end is written in EEPROM (step S144), and this routine is ended.

[0142] Drawing 15 and 16 are flow charts which show the 1st arm switch processing which is the subroutine called at step S133 of said drawing 14.

[0143] In this routine to switch the 1st arm 32 to a S/R, i.e., set/rewind, side Current, when the 1st arm 32 is already located in a S/R side, Moreover, current and when the 1st arm 32 is already located in a W/Z side, since it is not necessary to switch the 1st arm 32, this routine is ended as it is to switch the 1st arm 32 to a W/Z, i.e., wind/zoom, side (step S 145-147).

[0144] Although it is necessary to rotate the 1st arm 32 except an above-mentioned condition, as mentioned above, in order for the stop to have started with the 1st stopper 35 and to rotate it, it is necessary to energize the 1st arm 32 to the lever driver 40, and it needs to pull up the 1st stopper 35.

[0145] Then, in step S148, a looseness drive is performed and processing which pulls up the 1st stopper 35 is performed.

[0146] According to the drive situation of the camera before performing a gear change-over, a gear bites and a condition becomes various things.

[0147] When the location of the 1st current arm 32 is in a set/rewinding side, after making a motor 20 drive in the direction of CCW, and the 1st stopper 35 and the 1st arm 32 make a motor 20 drive in the direction of CW again, the 2nd stopper 41 and the 2nd arm 45 will have bit, respectively.

[0148] Moreover, when the location of the current 1st arm 32 is in zoom/winding-up side, after making a motor 20 drive in the direction of CCW, and the 3rd stopper 72 and the 3rd arm 61 make a motor 20 drive in the direction of CW again, the 1st stopper 35 and the 1st arm 32 will have bit, respectively.

[0149] A motor 20 is made to drive until only a predetermined pulse number is detected by Motor PI in the direction which the 2nd arm 45 or the 3rd arm 61 can eat first, and can cancel \*\*\*\*, in order [ being such ] to eat and to cancel \*\*\*\*.

[0150] A motor 20 is made to drive by the pulse number of Motor PI which the 1st arm 32 eats [ by ] and makes \*\*\*\* cancel since this driving direction is equal to the direction which the 1st arm 32 is made to bite next.

[0151] The 2nd arm 45 or the 3rd arm 61 bites, and it is necessary to bite at this time, and for the discharge pulse number > 1st arm to bite, and to define a discharge pulse number in the range in which relation called a discharge pulse number is realized.

[0152] then -- this -- it bites and a discharge pulse number chooses a suitable pulse number from EEPROM105 with the drive situation and gear location of a camera.

[0153] At step S149, whether the 1st to 3rd stopper can pull up, and in order to check, a stopper PI 46 is chosen and started.

[0154] At step S150, an electrical potential difference is impressed to the lever driver 40, and the lever driver 40 is the 2nd configuration SH2. Predetermined time standby is carried out until it changes (step S151). It progresses to step S152.

[0155] The condition of a stopper PI 46 is checked at step S152. The lever driver 40 is the 2nd configuration SH2. If it becomes and has been lengthened by the 3rd stopper 72, the signal of a stopper PI 46 will be turned off and the rotation of the 1st arm 32 of it will be attained (refer to drawing 8 (A) or drawing 8 (B)). Since it still bites and the condition is not canceled when the signal of a stopper PI 46 continues being ON, energization of the lever driver 40 is cut (step S153), and step S148 is operated again. However, even if it performs count slack actuation of predetermined, when a stopper PI 46 does not turn off, it flies on a damage (step S154).

[0156] At step S155, a time amount limiter until it carries out change-over termination is set up. At step S156, a clutch PI 34 is chosen and started as a location detection means of the 1st arm 32.

[0157] And it progresses to step S157, and when switching the 1st arm 32 to a S/R side and switching a motor 20 in the direction of CW at a W/Z side, a motor 20 is made to drive in the direction of CCW.

[0158] At step S158, even if it checks a switching time timer and carries out predetermined time progress, when there is

no change of a clutch PI 34, it is made a damage and processing is terminated.

[0159] At step S159, when signal change of a clutch PI 34 is checked and there is no signal change, return processing is repeated to S157. When signal change of a clutch PI 34 is detected, it progresses to step S160.

[0160] Even if the signal of the above-mentioned clutch PI 34 changes, the location of the 1st arm 32 chooses Motor PI, in order to move the 1st arm 32 till change-over termination completely a S/R side, since [ of W/Z ] it is mostly located in the mid-position (step S160).

[0161] At step S161, the drive of the motor in the above-mentioned step S157 is continued, in S162, even if it checks a switching time timer and carries out predetermined time progress, when a change-over is not completed, it is made a damage and processing is terminated. At step S163, when it drives by the change-over termination pulse number or a predetermined pulse number drive has not been checked and carried out, return processing is continued to step S161. When having carried out the predetermined pulse number drive is detected, it progresses to step S164.

[0162] At step S164, since the change-over pulse drive was carried out, brakes are applied to a motor and it is stopped. Energization of the lever driver 40 is intercepted at step S165. A stopper PI 46 is chosen at step S166, and the lever driver 40 is the 1st configuration SH1 at step S167. Predetermined time waiting and the lever driver 40 are the 1st configuration SH1 until it returns. Whether return and the 3rd stop 73 fell and in order to check, a stopper PI 46 is started.

[0163] The signal of a stopper PI 46 is checked at step S168. When a condition is OFF, the 1st to 3rd one of stoppers is going up. In that case, it flies to a damage as change-over failure. When a stopper PI 46 is ON, it progresses to step S169.

[0164] At step S169, the positional information about the 1st arm 32 is changed, and processing is terminated.

[0165] Drawing 17 is a set gear switch processing flow chart for switching the 2nd arm 45 called at step S136 of drawing 14 to a set location from a rewind location (switch in the condition of drawing 5 (A) of drawing 7 (B) from a condition).

[0166] First, in case the 2nd arm 45 is switched to the condition of gearing on the set gear 48, in judging whether it is in the location where the 2nd arm 45 has already geared on the set gear 48 (step S170) and being in the location, it terminates this routine, without doing anything (condition of drawing 5 (A)).

[0167] On the other hand, in being in the location where the 2nd arm 45 has geared on the gear 49 of a rewinding system, the stopper PI 46 which shades and has been turned off as a location detection means is chosen (step S171), and it sets up the guard timer (limiter) of switching time (step S172).

[0168] And a motor 20 is set as a predetermined constant voltage, and it is made to drive in the direction of CCW (step S173). This drives the 2nd arm 45 in the direction of CCW.

[0169] Then, when it judges whether predetermined time passed (step S174) and falling detection of a stopper PI 46 is not obtained within predetermined time (i.e., when the detecting signal to the ON from OFF is not obtained), it judges that it is switch failure and judges whether it is the 1st time (step S175). In being the 1st time, it returns to the above-mentioned step S170, and performs a re-try, and in being the 2nd time, it jumps to damage processing.

[0170] It judges whether when predetermined time had not passed yet in the above-mentioned step S174, falling (from OFF to ON) of a stopper PI 46 was detected (step S176), and when not detected, it returns to the above-mentioned step S173.

[0171] Moreover, if falling of a stopper PI 46 is detected, brakes will be applied to a motor 20 and it will be stopped (step S177). And the positional information about the 2nd arm 45 is updated at the last (step S178), and this routine is ended at it.

[0172] Drawing 18 and 19 are the flow charts of the rewind gear switch processing for switching the 2nd arm 45 called at step S137 of drawing 14 to a rewind location from a set location (switch to drawing 7 (B) from drawing 5 (A)).

[0173] First, in case the location of the 2nd arm 45 is switched to the location which can drive the rewind gear 51, when the 2nd arm 45 judges whether it is in the condition that the rewind gear 51 can be driven (step S179) and is already in the condition which can be driven, this routine is terminated without doing anything.

[0174] Moreover, when it will be in the condition which can be driven, actuation which switches the 2nd arm 45 to the condition which can be rewind driven will be performed, but since this 2nd arm 45 is stopped by the 2nd stopper 41, it is necessary to make the lever driver 40 turn on and to cancel the stop condition of the 2nd arm 45 first, at this time. For this reason, a looseness drive is performed, an electrical potential difference is impressed to the lever driver 40, and a stopper PI 46 is made to turn off.

[0175] That is, before performing the above-mentioned looseness actuation, any of the 2nd arm 45, the 2nd stopper 41, or the 1st arm 32 and the 1st stopper 35 they are has bit. In order [ this ] to eat and to cancel \*\*\*\*, after driving a motor 20 in the direction of CCW by the predetermined pulse number by Motor PI, drive in the direction of CW shortly and the lever driver 40 is made to energize, and it is the 2nd configuration SH2. It carries out and the condition of a stopper PI 46 is detected (steps S180-S184).

[0176] When a stopper PI 46 is ON, looseness actuation is performed again. Even if it performs count looseness actuation of predetermined, when a stopper PI 46 does not become off, it considers as a damage (steps S185 and S186). After detecting OFF of a stopper PI 46, Motor PI is chosen as a location detection means, and the amount of drives of a motor 20 is detected (step S187).

[0177] Next, a limiter is set as time amount until it ends the change-over actuation to the rewind gear 51 (step S188). And while the lever driver 40 had been made to energize, a motor 20 is driven in the direction of CW (step S189).

[0178] Then, when it judges whether predetermined time passed (step S190), it flies on a damage and processing is terminated, when having passed, and predetermined time has not passed, it judges whether the output of Motor PI was detected by the change-over pulse number (step S191).

[0179] If it, on the other hand, detects return and having driven the motor 20 by the change-over pulse number to the above-mentioned step S189 when a change-over pulse number is not reached, a motor 20 will be stopped by the motor brake (step S192).

[0180] And after a motor 20 stops, energization of the lever driver 40 is turned off (step S193), a stopper PI 46 is chosen as a location detection means (step S194), and the lever driver 40 is the 1st condition SH1. It waits to return (step S195). And the condition of a stopper PI 46 is detected (step S196).

[0181] When the stopper PI 46 turns on, it is in the middle of a gear switch, and since it is possible that the stopper has fallen, it shifts to damage processing.

[0182] Moreover, in the above-mentioned step S196, when it is checked that the stopper PI 46 turns off (protection from light), the positional information about the 2nd arm 45 is updated (step S197), and this routine is ended.

[0183] Drawing 20 is the flow chart of the zoom gear switch processing for switching the 3rd arm 61 called at step S139 of drawing 14 to a zoom location from a wind location (switch to drawing 6 (A) from drawing 7 (A)).

[0184] If this actuation starts, when the 3rd arm 61 will judge whether it is in the location which already gears on the zoom gear 65 (step S197) and will already have geared first, this routine is terminated as it is.

[0185] Moreover, when having not geared, a stopper PI 46 is chosen as a location detection means for switch control (step S198), and the motorised electrical potential difference at the time of making the 3rd arm 61 drive is set up (step S199).

[0186] A limiter is set as time amount until the 3rd arm 61 ends a switch in a zoom location from a wind location (step S200).

[0187] A motor 20 is made to drive in the direction of CW by the driver voltage by which a setup was carried out [ above-mentioned ] (step S201), and if it judges having judged whether the limiter in which time amount carried out [ above-mentioned ] a setup was reached (step S202), and having exceeded the set-up time amount, it will shift to processing of a damage.

[0188] In addition, when it is in the location where the 3rd arm 61 gears on the wind gear 70, a stopper PI 46 is an ON state.

[0189] By making a motor 20 drive in the direction of CW, the 3rd arm 61 lifts the 3rd stopper 72. If the 3rd arm 61 rotates to a position, the standup to which the output of a stopper PI 46 changes from ON (light transmission) at OFF (protection from light) will be obtained.

[0190] In detecting whether this standup was obtained (step S203) and not detecting it yet, it returns to the above-mentioned step S201.

[0191] Moreover, when detecting that the stopper PI 46 became off, a motor 20 is made to drive in the direction of CW further (step S204).

[0192] Then, when having judged whether time amount reached the setup time (step S205), and having exceeded the set-up time amount is judged, it shifts to processing of a damage.

[0193] If the 3rd arm 61 arrives at the location of the zoom gear 65, a stopper will fall and falling (change of OFF to ON) of a stopper PI 46 will be acquired.

[0194] So, in detecting whether this falling was acquired when it was in the setup time in the above-mentioned step

S205 (step S206) and not detecting it yet, it returns to the above-mentioned step S204.

[0195] Moreover, when falling of a stopper PI 46 is detected, brakes are applied to a motor 20 and it is stopped (step S207).

[0196] Finally, the positional information of the 3rd arm 61 is updated (step S208), and processing of this routine is terminated.

[0197] Drawing 21 and 22 are the flow charts of the wind gear switch processing for switching the 3rd arm 61 called in step S140 of drawing 14 to a wind location from a zoom location (switch to drawing 7 (A) from drawing 6 (A)).

[0198] In case the 3rd arm 61 is switched to the location which gears on the wind gear 70, when it judges whether it is in the location where the 3rd arm 61 already gears on the wind gear 70 (step S209) and is in the gearing location, this routine is ended as it is.

[0199] When having not geared yet, the 3rd arm 61 has required the stop with the 3rd stopper 72 so that it may not switch to the location which gears on the wind gear 70, even if it drives a motor 20 in the direction of CCW. Therefore, when switching the 3rd arm 61 to a wind location from a zoom location, the lever driver 40 is made to energize, and it is the 2nd configuration SH2. It is necessary to carry out and to cancel a stop of the 3rd arm 61.

[0200] Then, first, it energizes to the lever driver 40 after looseness drive activation, and off detection of the stopper PI 46 by stopper discharge is performed (step S214).

[0201] Before performing the above-mentioned looseness drive, any of the 3rd arm 61, the 3rd stopper 72, or the 1st arm 32 and the 1st stopper 35 they are bites, and it is in the condition. After driving a motor 20 in the direction of CW by the predetermined pulse number with the output of Motor PI, it is made to drive in the direction of CCW, in order [ this ] to eat and to cancel \*\*\*\*.

[0202] After making the level driver 40 energize, detecting the condition of a stopper PI 46 and detecting that this stopper PI 46 became off, Motor PI is chosen as a location detection means, and the amount of drives of a motor 20 is detected (step S217). When a stopper PI 46 is ON, the re-try of looseness actuation is performed. Even if it carries out count activation of predetermined, when a stopper PI 46 is ON, it considers as a damage (steps S215 and S216).

[0203] Next, a limiter is set as time amount until the 3rd arm 61 switches from a zoom location to a wind location (step S218). Then, while the level driver 40 had been made to energize, a motor 20 is driven in the direction of CCW (step S219).

[0204] And when it judges whether predetermined time passed (step S220), it switches into predetermined time and a termination pulse is not outputted, it judges that the gear switch went wrong and flies to damage processing. It judges whether only the pulse number required for the gear switch set up beforehand to be still in predetermined time was driven (step S221), and when having not reached, it returns to the above-mentioned step S219.

[0205] When only a required pulse number is driven, after applying brakes to a motor and stopping it on the other hand, the energization to the lever driver 40 is turned off (step S223). After turning off energization of the lever driver 40, in order to detect the condition of a stopper, a location detection means is switched to a stopper PI 46 from Motor PI (step S224). The lever driver 40 is the 1st configuration SH1. When a stopper PI 46 is OFF after waiting to return (S225), it considers as switch failure and considers as a damage (step S226).

[0206] Finally the positional information of the 3rd arm 61 is updated (step S227), and this routine is ended.

[0207]

[Effect of the Invention] In the above-mentioned invention, drive control of the stop member of the epicyclic gear device in a gear coupling device is performed using the driving member which consists of a shape memory alloy with which a different configuration from a steady state is memorized as mentioned above. Therefore, it becomes possible to switch driving force of an epicyclic gear device by power saving compared with the case where can arrange the above-mentioned gear coupling device to a small tooth space, and the above-mentioned electromagnet equipment is driven, without using a complicated device, large-sized electromagnet equipment, etc. like before.

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[Translation done.]



**\* NOTICES \***

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

[Drawing 1] It is 1 operation gestalt of this invention, and is the expansion perspective view showing the configuration of a gear coupling device and one drive condition which are built in a zoom camera.

[Drawing 2] It is the expansion perspective view showing other one drive condition in the gear coupling device of above-mentioned drawing 1 .

[Drawing 3] It is the expansion perspective view showing other one drive condition in the gear coupling device of above-mentioned drawing 1 .

[Drawing 4] It is the expansion perspective view showing other one drive condition in the gear coupling device of above-mentioned drawing 1 .

[Drawing 5] It is the top view showing the operating state of the gear coupling device of above-mentioned drawing 1 , and drawing 5 (A) and (B) show a certain operating state, respectively.

[Drawing 6] It is the top view showing the operating state of the gear coupling device of above-mentioned drawing 1 , and drawing 6 (A) and (B) show a certain operating state, respectively.

[Drawing 7] It is the top view showing the operating state of the gear coupling device of above-mentioned drawing 1 , and drawing 7 (A) and (B) show a certain operating state, respectively.

[Drawing 8] It is the top view showing the operating state of the gear coupling device of above-mentioned drawing 1 , and drawing 8 (A) and (B) show a certain operating state, respectively.

[Drawing 9] It is the perspective view of the mirror frame of the zoom camera having the gear coupling device of above-mentioned drawing 1 , and the condition when being in a stowed position is shown.

[Drawing 10] It is the perspective view of the mirror frame of the zoom camera having the gear coupling device of above-mentioned drawing 1 , and the condition of having let out to the location which can be photoed is shown.

[Drawing 11] It is an operating state Fig. when driving the 1st stopper with the lever driver built into the gear coupling device of above-mentioned drawing 1 , and drawing 11 (A) shows the normal state of not energizing [ of a lever driver ], and shows the condition that drawing 11 (B) carried out the rotation drive of the 1st stopper with the lever driver in an energization condition.

[Drawing 12] It is the block block diagram of the control device of the zoom camera having the gear coupling device of above-mentioned drawing 1 .

[Drawing 13] It is the flow chart of a photography sequence including drive control of the gear coupling device after the power-source ON in the camera of above-mentioned drawing 12 .

[Drawing 14] It is the flow chart of switch processing of each gear called by the photography sequence of above-mentioned drawing 13 .

[Drawing 15] It is a part of flow chart of the 1st arm switch processing called by the routine of above-mentioned drawing 14 .

[Drawing 16] It is a part of flow chart which shows the 1st arm switch processing called by the routine of above-mentioned drawing 14 .

[Drawing 17] The flow chart which shows the set gear switch processing called by the routine of above-mentioned drawing 14 .

[Drawing 18] A part of flow chart which shows the rewind gear switch processing called by the routine of above-mentioned drawing 14 is shown.

[Drawing 19] A part of flow chart which shows the rewind gear switch processing called by the routine of above-mentioned drawing 14 is shown.

[Drawing 20] It is the flow chart of the zoom gear switch processing called by the routine of above-mentioned drawing 14 .

[Drawing 21] It is a part of flow chart of the wind gear switch processing called by the routine of above-mentioned drawing 14 .

[Drawing 22] It is a part of flow chart which shows the wind gear switch processing called by the routine of above-mentioned drawing 14 .

[Description of Notations]

30 .... 1st Sun Gear (Sun Gear)

31 .... 1st Planet Gear (Planet Gear)

32 .... 1st Arm (Connection Arm)

35 .... 1st Stopper (Stopper Member)

1 .... Lever Driver (Driving Member Which Consists of a Shape Memory Alloy)

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[Translation done.]